

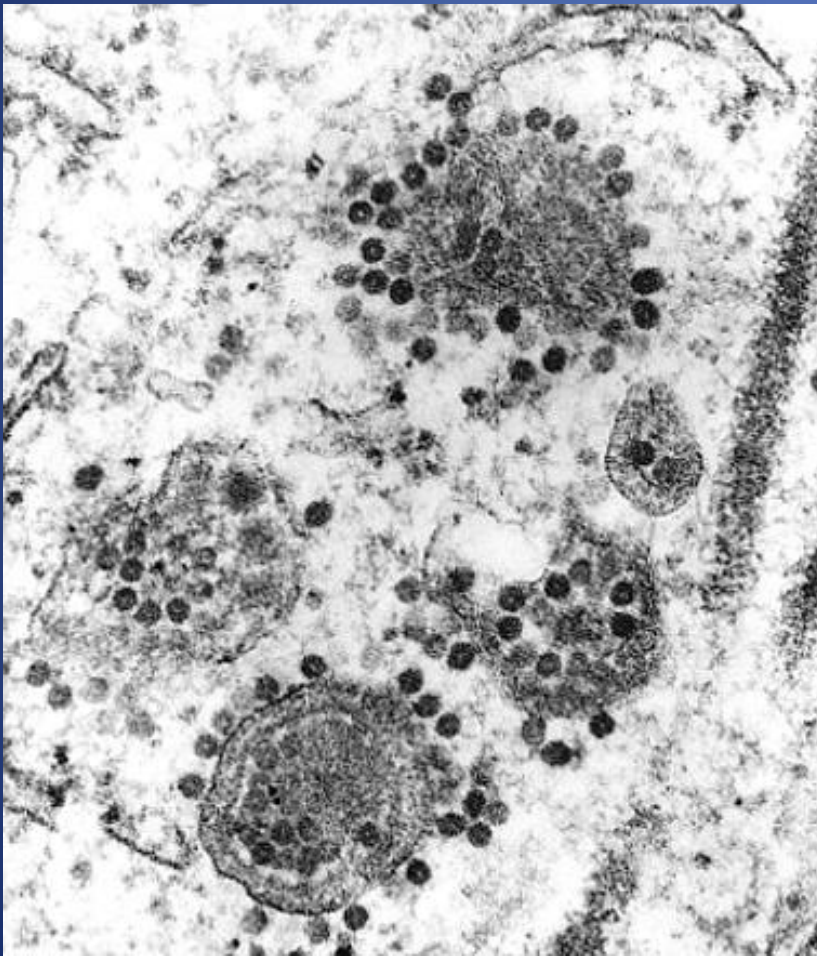
EEE Ecology, Sentinel Flocks and Mosquito Surveillance

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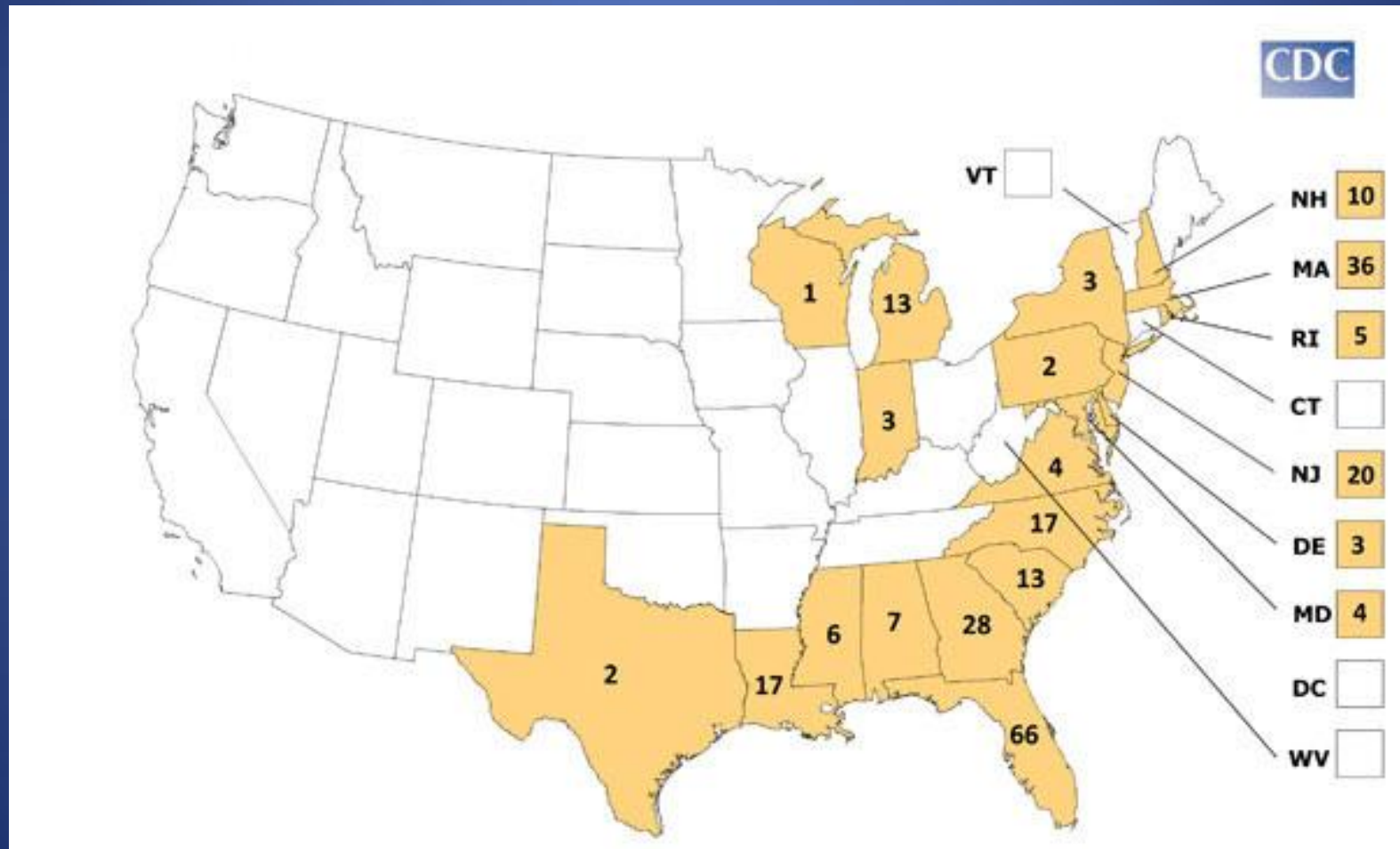
Public Health Pest Management Section

Eastern Equine Encephalitis Virus

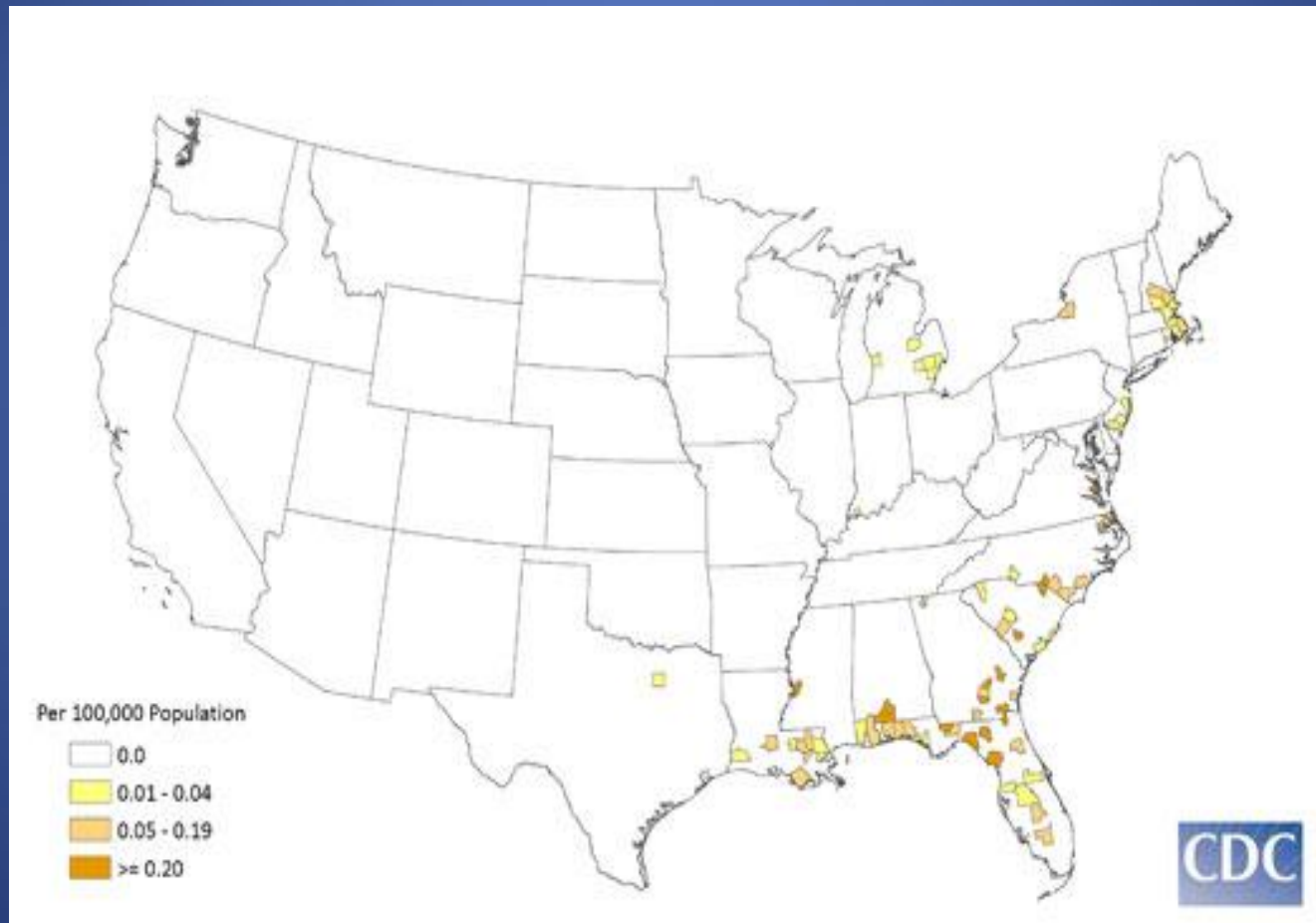


Eastern equine encephalitis virus (EEEV) is a member of the genus Alphavirus, in the family Togaviridae. Other medically important alphaviruses found in the Americas include Western equine encephalitis virus (WEEV) and Venezuelan equine encephalitis virus (VEEV). Alphaviruses found elsewhere in the world include Ross River and Chikungunya.

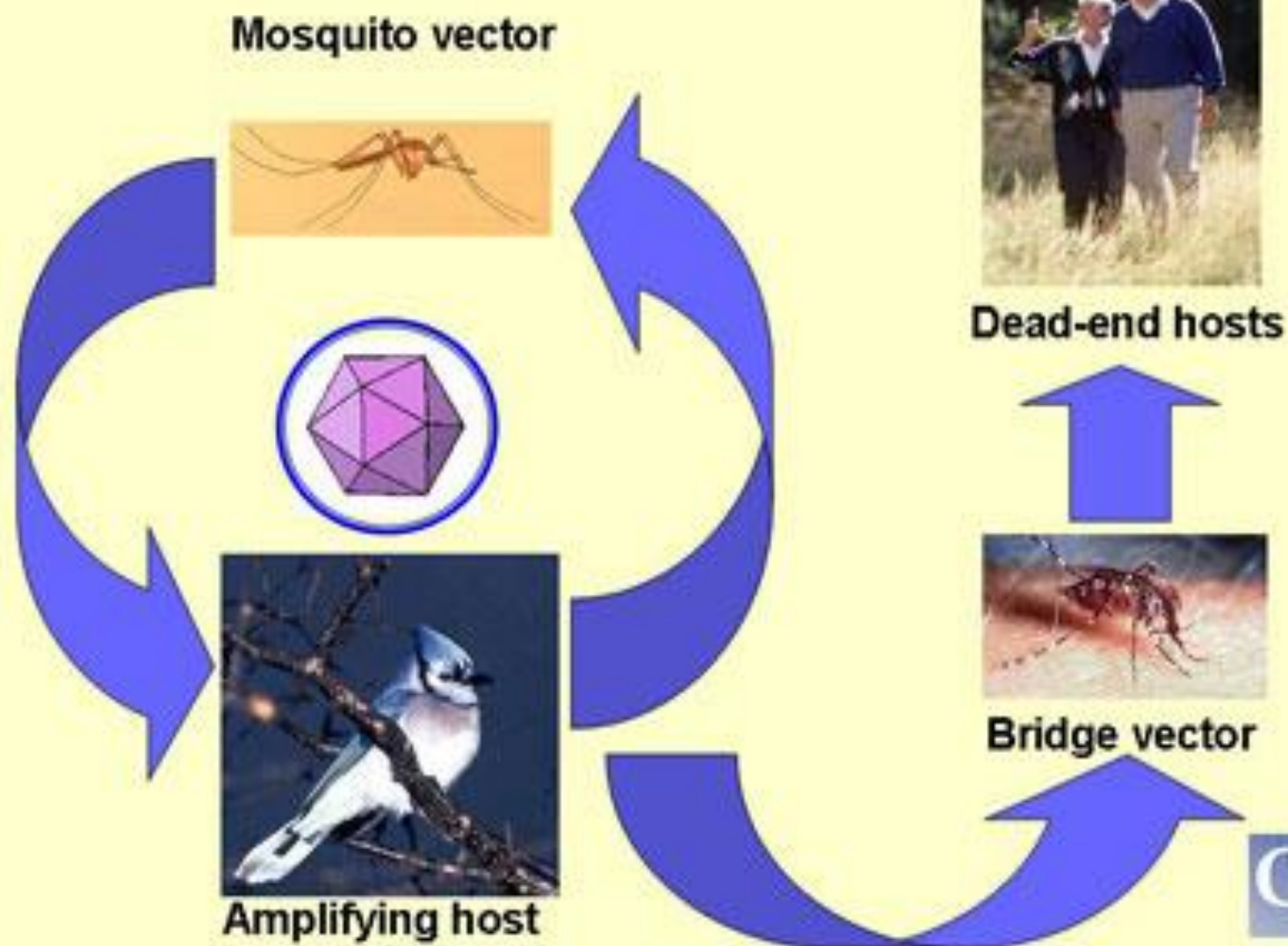
Eastern Equine Encephalitis Virus Neuroinvasive Disease Cases Reported by State, 1964-2009



Eastern Equine Encephalitis Virus Neuroinvasive Disease Average Annual Incidence by County, 1996-2009



Transmission cycle of EEEV



EEEV Primary Hosts



EEEV Dead End Hosts



Key Features of EEEV Transmission

- *Culiseta melanura* is the enzootic vector of EEEV; it is a strongly ornithophilic feeder.
- EEEV is non-fatal to native birds, viremia lasts several days.
- Enzootic cycle is always present, spillover to mammalian hosts is irregular.
- "Bridge" vectors are thought to be needed to span the enzootic cycle from birds to mammals. A recent study suggests that EEEV is too uncommon and titers too low in mosquitoes other than *Cs. melanura* to support transmission to mammals. Even low levels of cross-feeding by *Cs. melanura* might account for occasional transmission to mammals.
- Numerous mosquito species shown to be potential bridge vectors.
- Transovarial transmission is not significant, therefore 2 or more feedings are required to transmit virus.
- Extrinsic incubation period is ca. 14 days, therefore older mosquitoes are more significant as vectors than young mosquitoes.

Culiseta melanura

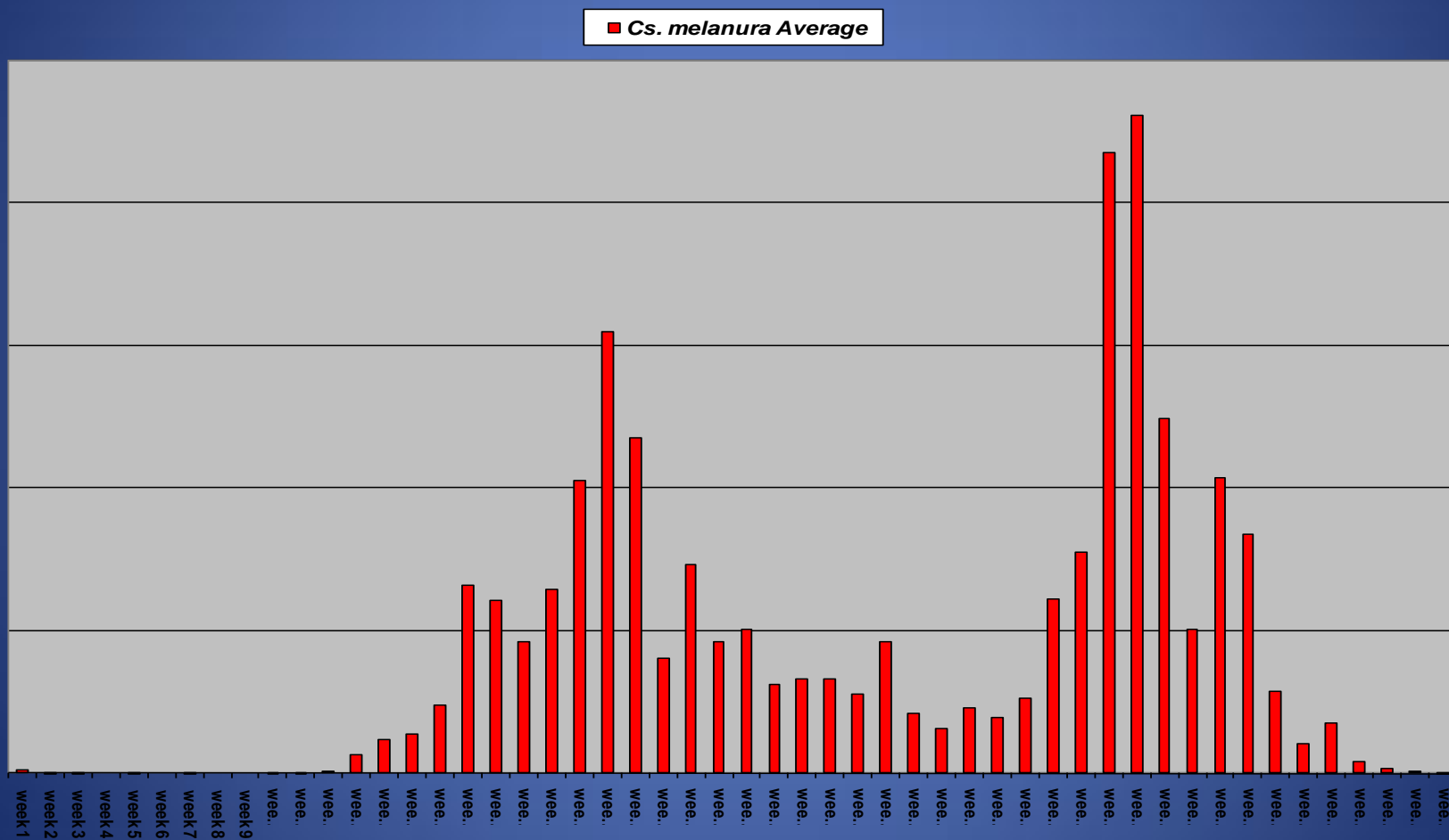
- A strongly ornithophilic feeder that breeds in the cooler temperatures of spring and fall.
- Uses a very specialized breeding site in “crypts” created by tree roots or by fallen/rotted trees in swamps.



Mosquito Feeding on Bird



Culiseta melanura Brunswick Co. NC 2001-2010



EEEV Surveillance Options

- Mosquito population monitoring
- Virus isolation from mosquitoes
- Wild bird capture and testing
- Sentinel chicken testing
- Horse cases
- Human cases

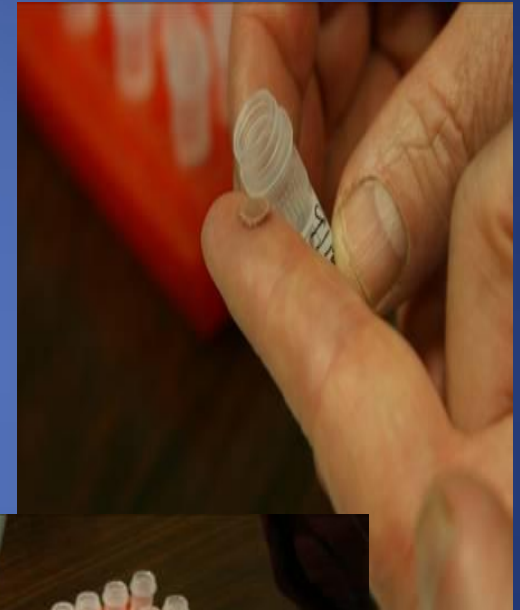
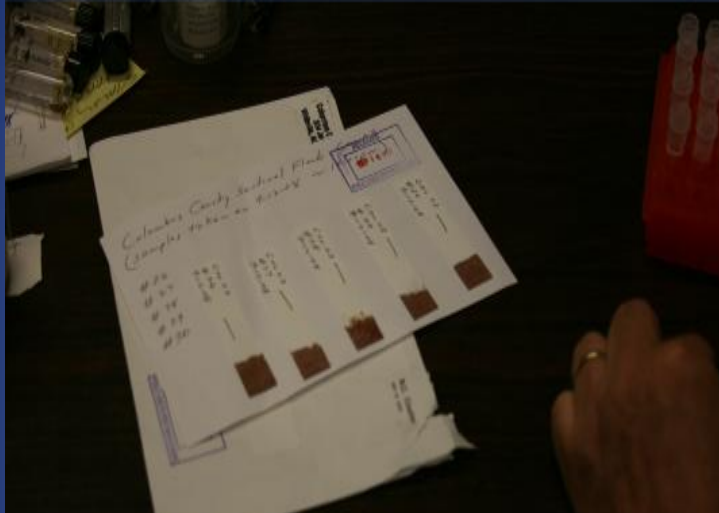
Advantages of Sentinel Chickens

- Very labor and cost friendly
- Little training needed to take samples
- Known location and approximate time of exposure
- Round the clock exposure
- Can cover a wide surveillance area
- Quick turn around time for lab results
- Detection is early in transmission cycle,
i.e., pre-mammalian exposure

Taking Sentinel Samples-Local Programs



Processing Sentinel Samples-PHPMS

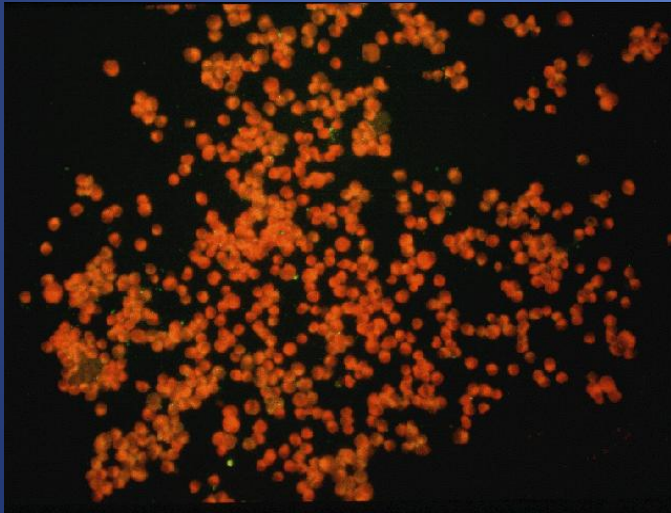


IFA Testing Sentinel Samples - SLPH

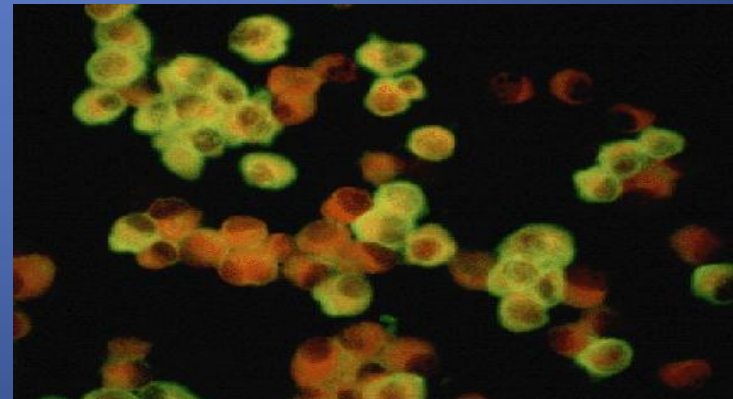
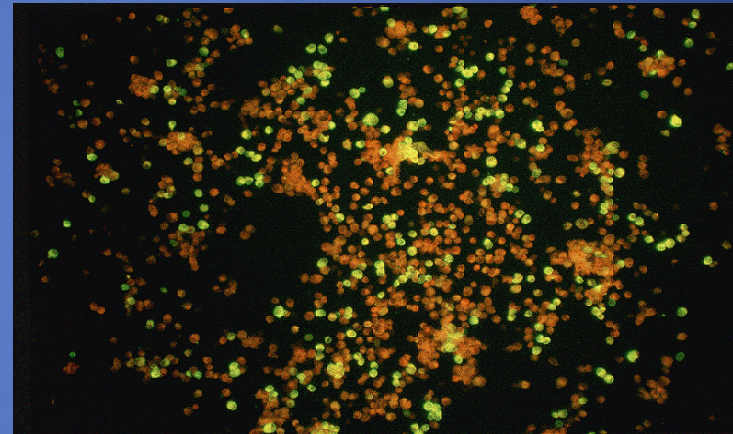


Reading Sentinel IFA Test-SLPH

- IFA negative

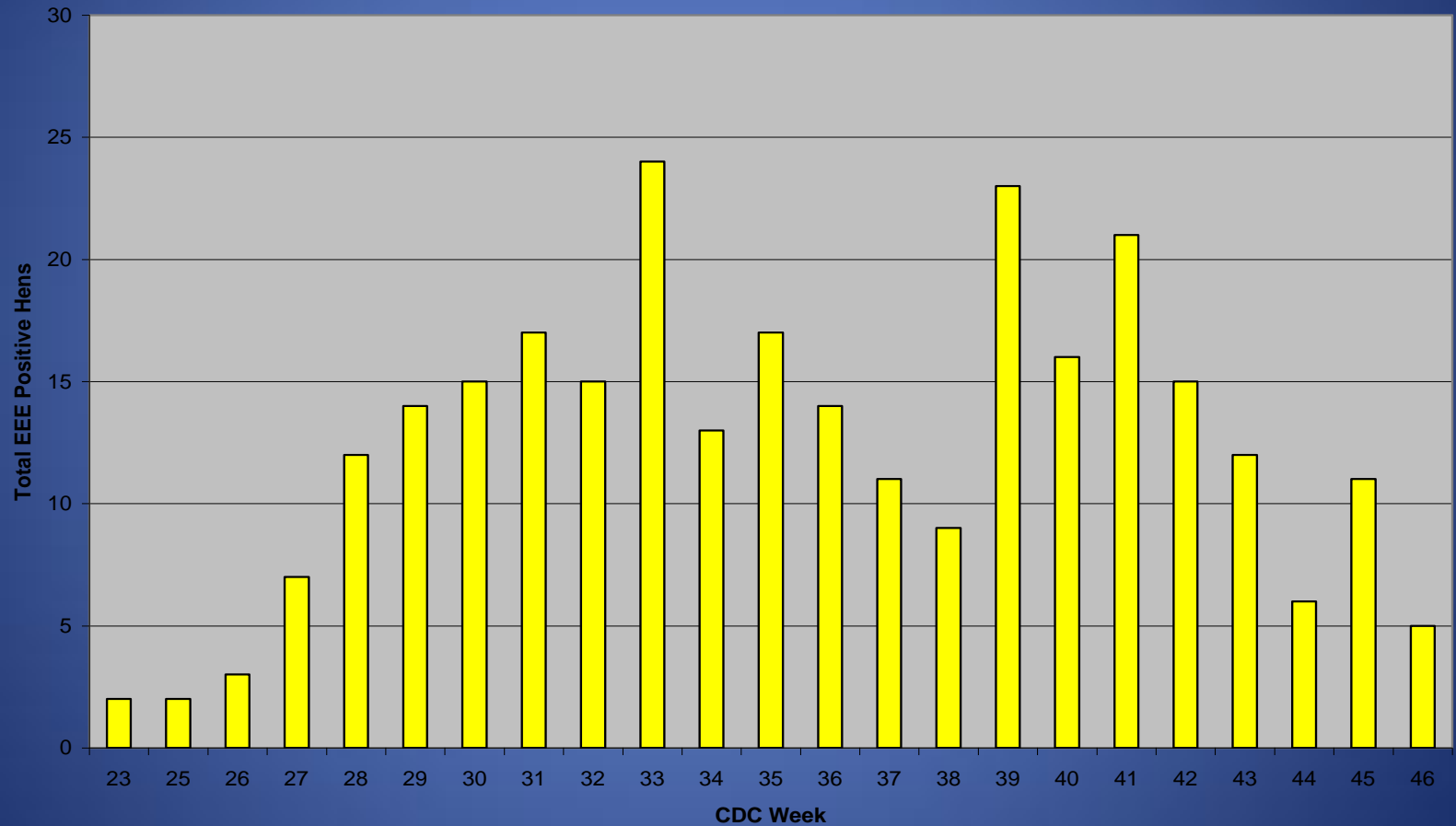


- IFA positive



Positive Chickens 2001-2010

Total EEE Positive Sentinel Hens by Week (2001-2010)



The Art of Sentinel Chicken Surveillance

- Sentinels are a tool to measure virus activity in a focal area. Flocks across a wider geographic range may give an overall picture of low or high virus activity.



Very early sentinel activity.



Large number of positives per sampling period.



Unusual activity in low activity flocks.

- Individual positive chickens have not correlated with human or equines cases in an area.

Local Responses to Positive Sentinels

- Spray affected area to control adult mosquitoes
- Issue advisory/reminder about mosquitoes, disease and precautions. Example:

EEE Caution Being Urged

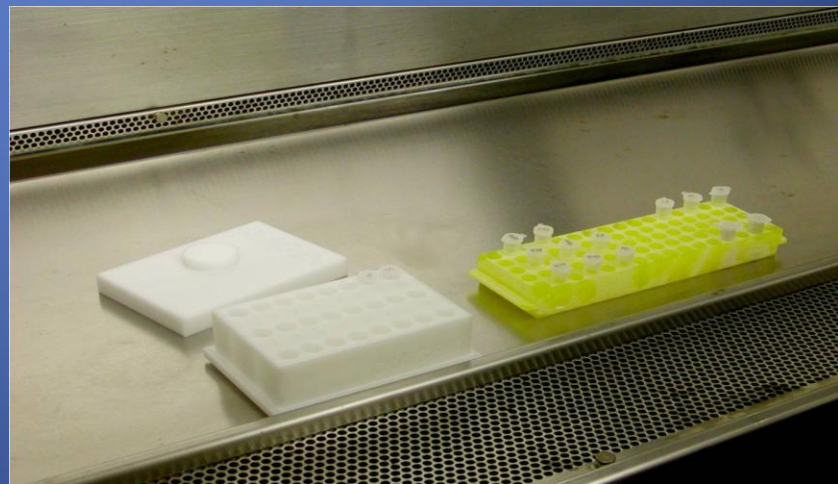
By CHRIST PROKOS

Staff Writer

Published: Sunday, September 19, 2010 2:26 AM EDT

The Beaufort County Health Department is urging residents to take precautions to prevent mosquito bites after a horse tested positive for Eastern Equine Encephalitis earlier this month and was euthanized. A rare disease, Eastern Equine Encephalitis is more common in the eastern parts of North Carolina. It is transmitted by some species of mosquitoes. The viral illness causes an inflammation of the brain and can be fatal to both animals and humans. If the right mosquito bites a human at the right time, they could get it," cautioned Eugene McRoy, program specialist for the Beaufort County Health Department's Environmental Health Division. "EEE tends to be rare, but it does show up, and September seems to be the time it shows up. September tends to be the peak month because it is not too hot and not too cold." Flu-like symptoms, which can develop up to two weeks following a mosquito bite, include rapid onset of fever and headache. Since there is no cure for EEE, medical professionals are limited to treating the symptoms of the disease. North Carolina averages about one human case and 10 equine cases of EEE each year. Young children and the elderly face the highest risk, and roughly 50 percent of human cases are fatal. "As far as horses getting it, there is no real concern because there is a vaccine for horses," McRoy said. "Most (owners) get them vaccinated in the spring, and it is relatively inexpensive. There isn't a vaccine for humans, and there are one or two cases a year for humans." The health department is cautioning people to avoid mosquito bites by reducing the time spent outdoors, especially in the early morning and early evening hours. Light-colored pants, long-sleeve shirts and mosquito repellent also are helpful in warding off mosquitoes. "Our main point was to let people know there was an occurrence and get them to take precautions," McRoy said. Residents also are encouraged to reduce mosquito breeding areas around their homes by removing any containers that can hold water, clearing debris from gutters, repairing leaky outdoor faucets, changing water in bird baths and pet bowls twice a week and using tight-fitting screened windows and doors.

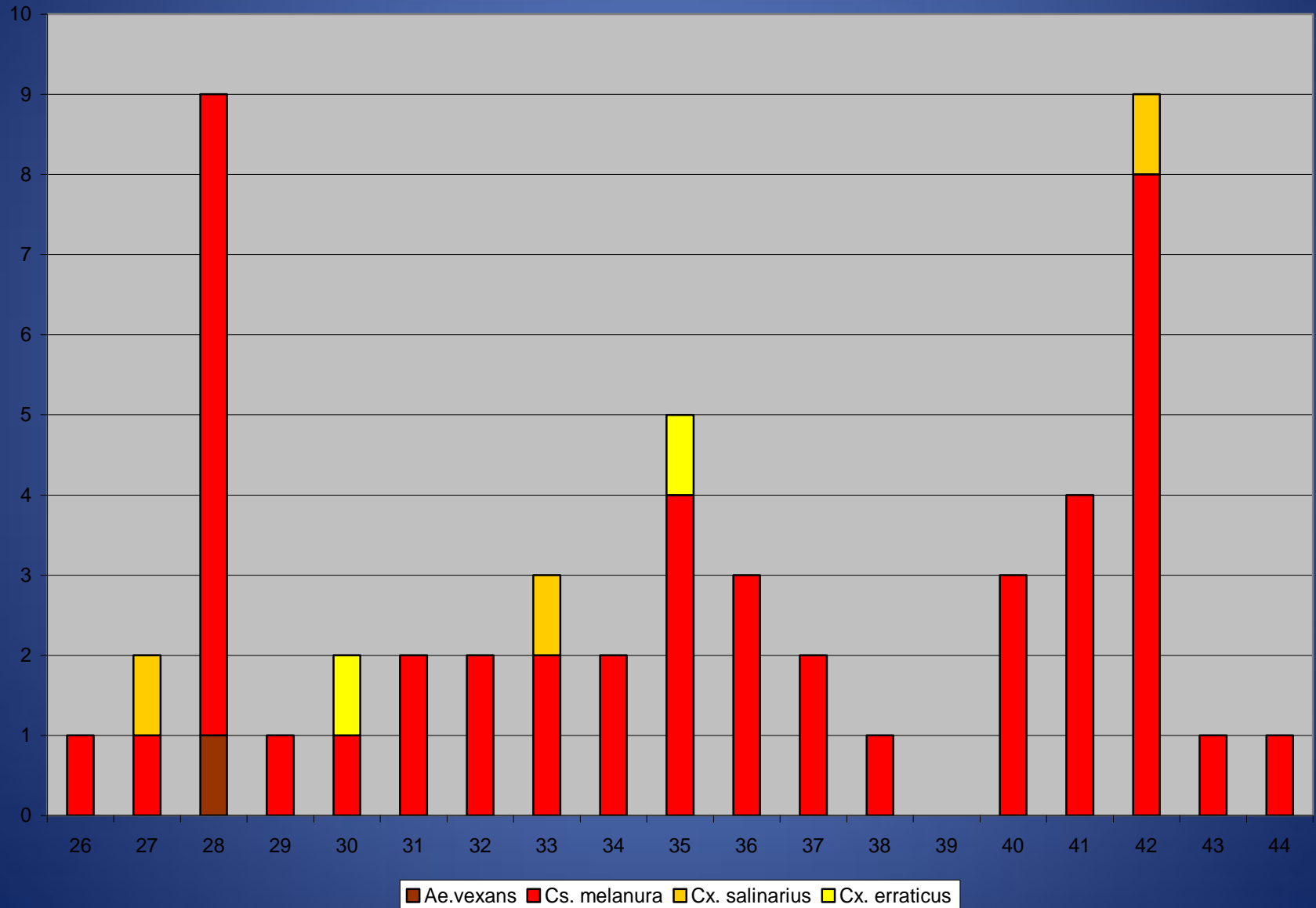
Mosquito Pooling -PHPMS & Local Programs



Testing Mosquito Pools-SLPH



EEEV Positive Mosquitoes NC 2001-2010

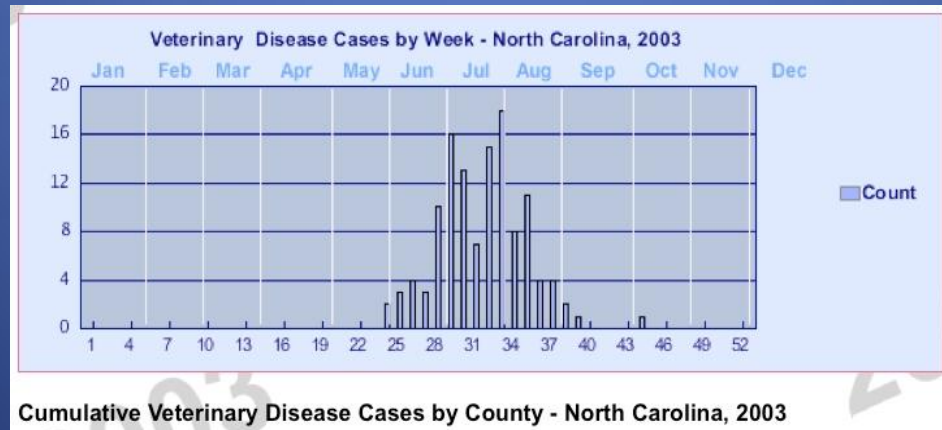
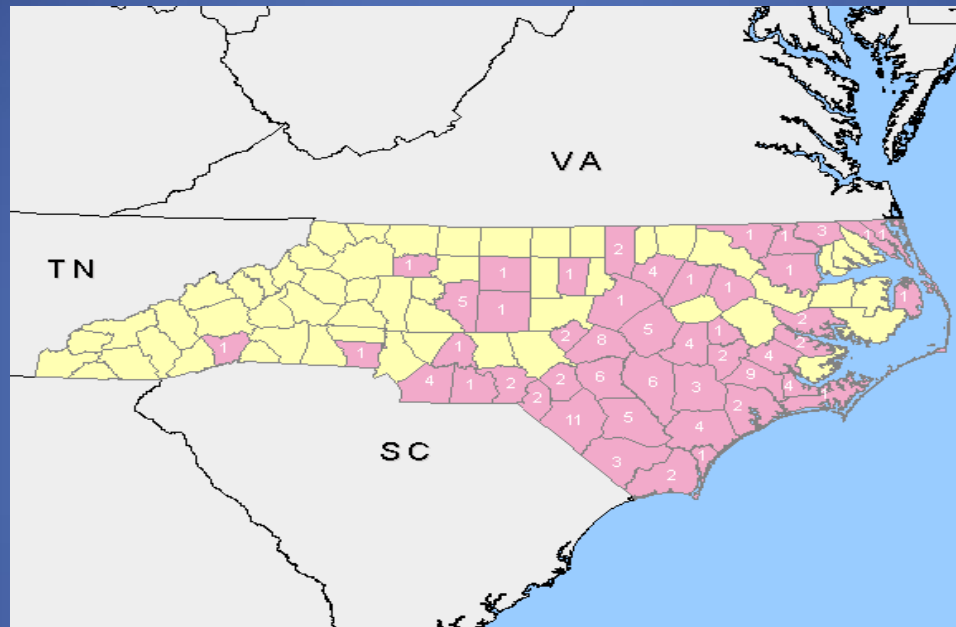


EEEV in NC from 2003-09

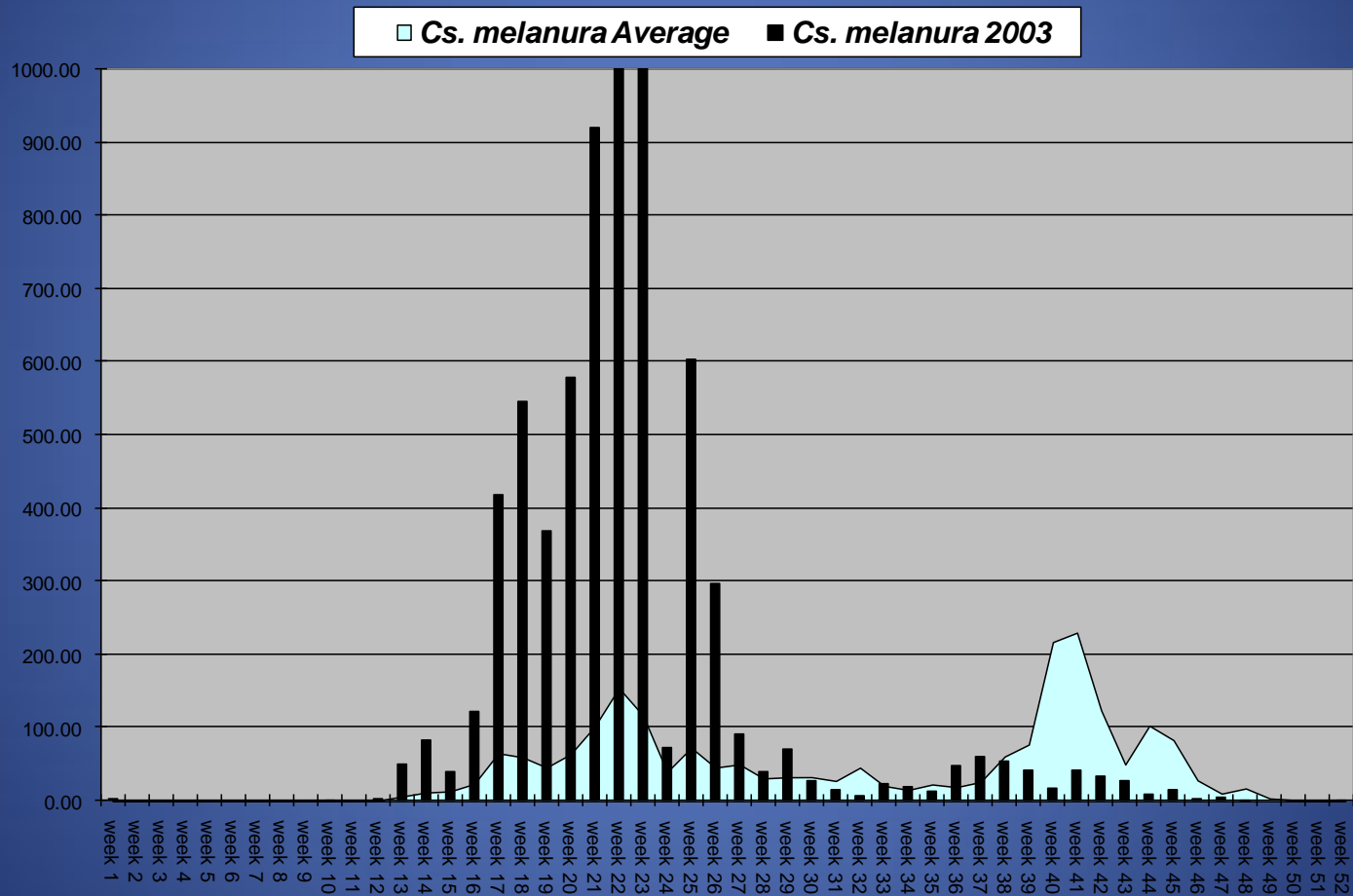
	Humans	Horses	Chickens	Mosquito Pools
2009	1	23	52	9
2008	1	13	19	3
2007	0	0	21	2
2006	1	5	35	5
2005	0	15	32	6
2004	1	6	33	16
2003	1	122	42	9
TOTALS	5	184	234	50

Based on USGS Disease Maps

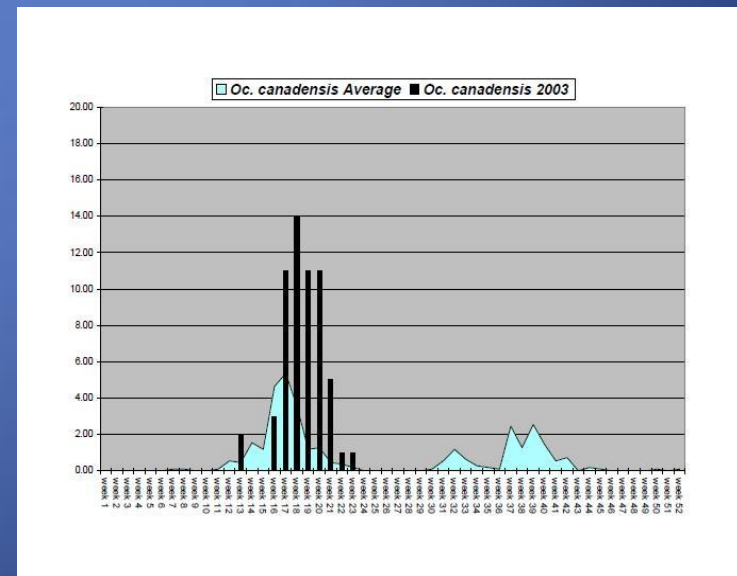
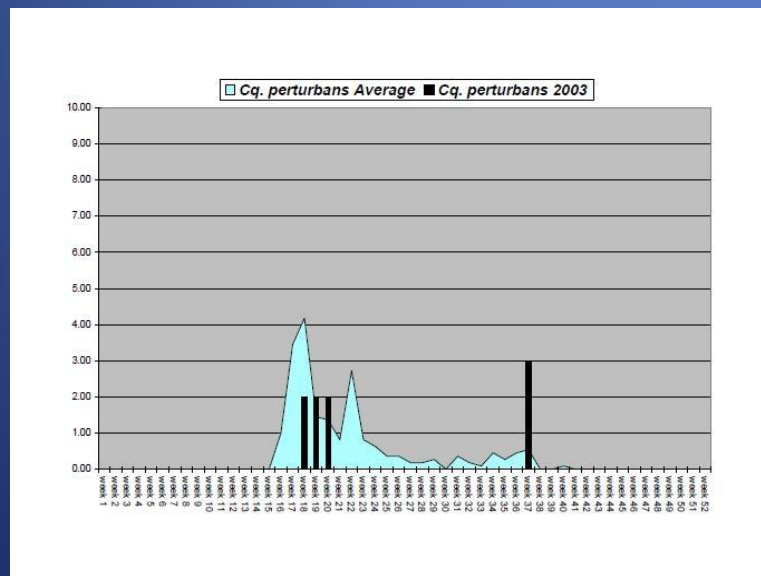
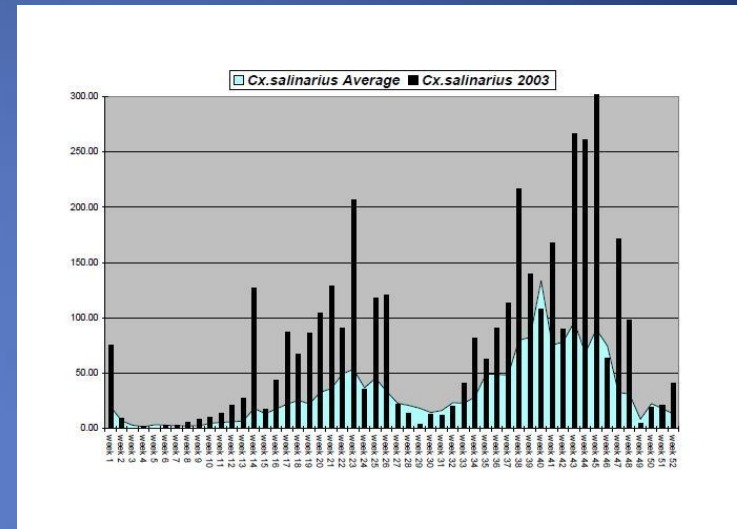
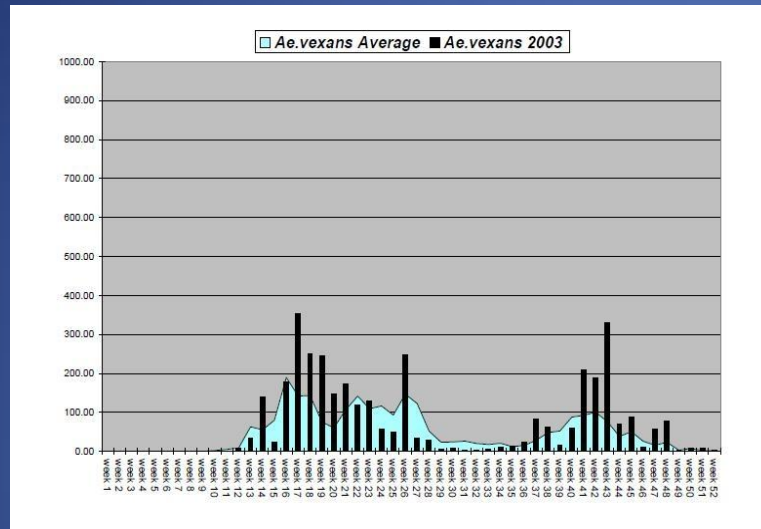
EEE Equines NC 2003



Culiseta melanura Brunswick Co. NC 2003



Bridge Vectors in Brunswick Co. NC 2003



What happened in 2003?

- Very large spring bloom of *Cs. melanura*.
- This coincided with nesting season and lead to explosion of virus in wild birds.
- Large *Cs. melanura* population means large numbers are likely to survive the extrinsic incubation period.
- Extensive early virus transmission seen in sentinels.
- Large *Cs. melanura* population means many might feed on both bird or mammals, and/or bridge vectors become involved with many horses being infected.

Thanks

PHPMS

Marcee Toliver

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SLPH

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NCDA

Tom Ray

BCMC

Jeff Brown

Rick Hickman

CDS

Jodi Reber

Carl Williams

Jean-Marie Maillard